RM
859
R313
v. 16
no. 3
c. 1
GERSTS

RADIUM

EDITED BY
CHARLES H. VIOL, Ph. D.
AND
WILLIAM H. CAMERON, M. D.

VOL. XVI DECEMBER, 1920 No. 3

CONTENTS

REVIEWS AND ABSTRACTS

Leda J. Stacy, M.D. Radium Treatment in 600 Cases of Menorrhagia - - - - - - - - 33

J. T. Geraghty, M.D. Value of Radium in the Treatment of Bladder Tumors - - - - - 37

Edward A. Shumway, M.D. Vernal Conjunctivitis; Its Treatment by Applications of Radium - - 40

Iser Solomon. Radio-Therapy in Germany (1914-1919). The Principles of Radio-Therapy - - 42

THE RADIUM INSTITUTE OF TORONTO 13 QUEEN ST.

LIBRARY NOV 3 1921 UNIVERSITY OF TORONTO

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

Edited and Published by Charles H. Viol, Ph. D., and William H. Cameron, M. D. with the assistance of collaborators working in the fields of Radiochemistry, Radioactivity and Radiumtherapy.

Subscription $2.50 per year, or 25 cents per copy in the United States and Canada in all other countries $3.75 per year.

Address all communications to the Editors, Forbes and Meyran Avenues, Pittsburgh, Pa.

VOL. XVI DECEMBER, 1920 No. 3

REVIEWS AND ABSTRACTS

Leda J. Stacy, M.D. (Section on Medicine, Mayo Clinic, Rochester, Minn.) Radium Treatment in 600 Cases of Menorrhagia. American Journal of Roentgenology, vii, 379-382, Aug. 1920. Read at the Fifth Annual Meeting of the American Radium Society, New Orleans, La., April 26, 1920.

"As the scope of treatment in any field of medicine increases, the results obtained in the individual case depend largely on the judgment used in selecting its form. Formerly surgery was the only effective treatment at our disposal in the management of menorrhagia and uterine myoma. We have now the roentgen rays and radium as definitely recognized therapeutic agents; and as our knowledge of the endocrine glands becomes more complete the internal secretions will be added to the therapeutic agencies which may be used in the treatment of menstrual disturbances."

"Surgery is still the treatment of choice for young women who have definite fibroids causing menorrhagia, or for those who have a normal sized uterus but a history suggesting the presence of an intra-uterine polyp or small submucous fibroid, and for those with a history suspicious of malignancy of the fundus of the uterus. We believe that the large fibroids are best treated by hysterectomy as a certain means of quickly removing the tumor, without the possibility of degenerative changes occurring later. It has been our policy to limit the use of radium to fibroids the size of a three and one-half to four months' pregnancy, unless there is a definite contraindication to operation."

"A hysterectomy should be advised in the cases in which there is a history suggestive of malignancy, for a negative diagnostic curettement

is not to be relied on in the definitely suspicious case, as the curette may miss the involved area."

"In the young woman who has a definite fibroid causing menorrhagia an abdominal myomectomy is the preferable treatment. By this method the tumor is removed, the menorrhagia controlled, and a uterus is preserved which is capable of carrying on the functions of menstruation and child-bearing."

"If a young woman has menorrhagia without a demonstrable tumor which cannot be controlled by medical treatment or by curettement, an abdominal hysterotomy may disclose a small submucous fibroid or polyp so situated that it could not be reached by the curette. Hysterotomy has been done in twenty-five cases at the Mayo Clinic; in seventeen in connection with a myomectomy, and in eight primarily as an exploration of the uterine cavity."

"It has been stated that the mortality is higher in myomectomy than in hysterectomy and that a later operation is often necessary; but in a series of 615 abdominal myomectomies performed at the Mayo Clinic from January, 1891, to January, 1920, the mortality was 0.5 per cent. Reports received from 373 patients show that twenty-one had a subsequent hysterectomy; two of these were performed immediately after the myomectomy because malignancy was found on microscopic examination. In eleven cases the operation was done five or more years after the myomectomy. A curettement was done eight years after myomectomy in one case, and a tumor was removed from the uterus in another thirteen years after the first operation. One patient had a child one year after myomectomy and a hysterectomy one and one-half years after the birth of the child. A second operation was necessary therefore in only 3.3 per cent. of the series of 619 myomectomies."

"The incidence of pregnancy occurring after myomectomy was most satisfactory. Reports have been received from 373 patients in answer to questionnaires. Two hundred ninety-six of these were married women. Forty-four have been pregnant since operation; eleven have had more than one child, and fifteen were definitely and two questionably pregnant when they reported. Six have had miscarriages. Two patients have been married since the operation; one has two children and one has one child. Twenty-three of the forty-four women who became pregnant after the myomectomy had not been pregnant before operation. At the time of operation nineteen patients were pregnant; in five the pregnancies were extra-uterine and in one case the fetus was dead. Pregnancy terminated in two of these cases in two or three days after operation. Six patients have been heard from who went to full term. One had a vaginal cesarean section six months after myomectomy; one had an abdominal cesarean section two years after operation. In both cases the child was living and the mother made a normal recovery."

"Although the length of time which has elapsed since the use of radium is too short to allow a comparison of the results of the radium treatment and myomectomy as to the incidence of subsequent pregnancy it is doubtful whether pregnancy will occur in so large a percentage of cases after the application of radium as after an abdominal myomectomy."

"Of the series of 600 patients with menorrhagia with or without uterine myomas treated with radium at the Clinic from July, 1915, to January, 1920, 438 have been heard from. Sixty-nine of these were married women under thirty-five. Normal full-term pregnancies occurred in three patients; two were women of twenty-two who had been

given two tubes of 25 mg. radium for four hours each; the other, aged twenty-six, had been given 25 mg. for nine hours. One patient aged thirty-one with small multiple fibroids was given two 25 mg. tubes for six hours and the periods became regular and normal; three years later she gave birth to a normally developed full-term dead child. Menstruation again became profuse two months after confinement and four months later 350 mg. hours were given. Two days after the treatment the patient developed a rapid pulse and evidence of shock, without rise in temperature or evidence of peritonitis, and died twelve days later. This is the only death in our series and has not been satisfactorily explained. One woman gave birth to a premature dead fetus after receiving 23 mg. radium for ten hours, and another gave birth to a premature deformed fetus, after receiving 50 mg. for six hours. One woman of thirty-seven who had 250 mg. hours had two miscarriages at three and six months. One woman of twenty-five, after 25 mg. for ten hours, is now six months pregnant. One woman aged thirty who had had 25 mg. radium for ten hours was questionably pregnant at the time she reported."

"In the treatment of menorrhagia in patients more than thirty-five who have a fibrous uterus or a small myoma, and in younger patients in whom myomectomy or hysterotomy is not indicated or in whom currettement has not controlled the menorrhagia, radium is a very satisfactory therapeutic agent. Radium should not be used, however, for patients who give a clinical history or present physical signs of pelvic infection or of pyometritis, nor for those who complain of chronic pelvic pain, since the application of radium may light up a quiescent infection. We have had three cases in which operation was done because of the infection after the application of radium, in one in five weeks, in one in six weeks, and in one in three months."

"In our series of 600 cases were 122 women under thirty-five; nineteen were twenty-five or under. Eighty-nine were heard from. The average dose of radium given to these patients was 293 mg. hours. Menorrhagia was controlled by one treatment in 55.6 per cent.; a second treatment was necessary to control the menstruation in seventeen cases. In twenty-five the periods were reported normal in amount, in eleven irregular and scant, and in six menstruation ceased; three of these patients, aged twenty-eight, thirty and thirty-four, respectively, had 300 mg. hours. Hysterectomy was performed later in six patients; one patient aged thirty-two was operated on eight months after receiving 400 mg. radium hours without improvement; one aged thirty was operated on after one year because of pelvic pain, although the profuse flow had not returned; one aged thirty-one was operated on after receiving 200 mg. hours treatment without relief; and one aged twenty-seven (a case of hemophilia and myoma) was given 300 mg. hours treatment, then transfused and given 400 mg. hours. Menstrual periods were regular for eight months, followed by continuous flowing for five weeks, when the hysterectomy was performed. One girl of sixteen was given 100 mg. hours one year after a currettement with only temporary improvement; the flowing was more or less continuous, and two years and nine months after the radium treatment a hysterectomy was performed; adenocarcinoma of the fundus was found. Abdominal myomectomy was performed in seven patients who received only temporary benefit following the radium treatment; two of these had had radium treatment a second time. We attempt to give the women under thirty-five enough radium to control the symptoms, but not enough to stop

menstruation, and it is difficult to judge the amount necessary in each case. It is better to give a small dose, however, and if there is a recurrence of the profuse flow, repeat the dose in three, four or six months, than to give enough at the first treatment to stop menstruation."

"Patients more than thirty-five are given larger initial doses, as it is not so important that menstruation shall continue. We have tried, however, to give a dose to all patients under forty which will control rather than stop menstruation. We have seldom given more than 50 mg. for fourteen hours at one treatment, since we believe that it is better to repeat the treatment if necessary, as it is sometimes in cases of a fairly large tumor. There were 478 patients more than thirty-five, and of this number 349 have been heard from. In eighty-one (23.2 per cent.) of these the examination showed the uterus to be "fibrous" or not "large." In 220 cases the uterus was graded 3 on a scale of 1, 2, 3, 4 or the fibroids graded 1, and in twenty-nine the fibroids were graded 2 or 3. Thus in the large percentage of cases the treatment was confined to the smaller tumors and the large doses given by many physicians were not used."

"In the series of 349 patients it was necessary to repeat the treatment in sixty-four, and an operation was done later in twenty. Only four of the twenty were given a second radium treatment, and two had operations elsewhere too soon after treatment to obtain the effect of the radium. Menstruation became regular and normal in thirty-nine (11.17 per cent.)"

"Of the patients more than forty, 263 were heard from; in 185 (70.35 per cent.) of these menstruation had ceased. Only fourteen of this group were given two treatments; four were given the two treatments close together; the other ten received the second treatment after from one month to one year. In the larger percentage of those cases in which menstruation ceased there were two periods following the treatment before the cessation. Improvement in general health was reported in 231 cases, and gain in weight in 157 cases. No improvement was reported in sixty-eight."

"Letters were not sent to patients treated within the last three months, because enough time has not elapsed to show what the ultimate results will be."

"Our technic has not varied materially from that which I described in a paper published in 1918, except that we now use either the emanation or the radium element, and are using slightly larger doses for older persons, but usually not more than 700 mg. hours. If this is not sufficient we prefer to repeat the treatment in a few weeks or months."

"CONCLUSIONS—1. In young women with fibroids causing menorrhagia radium should be used only in carefully selected cases, and in small amounts in the initial treatment.

"2. Pregnancy may occur after the application of radium, but in a small percentage of cases only.

"3. Abdominal myomectomy is preferable to radium in the treatment of women under thirty-five who have definite fibroids causing menorrhagia.

"4. Radium is the ideal treatment for menorrhagia in patients more than thirty-five who have a fibrous type of uterus, and for patients who have small fibroids and menorrhagia.

"5. In cases in which the history is suggestive of carcinoma of the fundus an abdominal hysterectomy is the safer procedure, and should

be advised even if the diagnostic curettement is negative for malignancy.

"6. Unless there is a definite contraindication we believe that large fibroids should be treated surgically because of the possibility that degenerative changes may occur in a tumor in which the blood supply has been interfered with, and because of the possibility of a mistaken diagnosis."

* * * * *

J. T. Geraghty, M.D. (Baltimore). Value of Radium in the Treatment of Bladder Tumors. Southern Med. Jour. viii, 511-514, July, 1920. Read in Section on Surgery, Southern Medical Association, 13th Annual Meeting, Asheville, N. C., Nov. 10-13, 1919.

"Until the introduction of fulguration by Beer, in 1910, as a method of treating bladder tumors, operative procedures had been employed exclusively. In most instances the method employed was the clamp and cautery for the papilloma and occasionally resection for the infiltrating type of tumor. The ultimate results obtained by operative methods in the treatment of papillomata were so discouraging that many of the prominent urologists throughout the world were strongly opposed to operating upon these cases except where the symptoms were such as to demand relief. It began to be recognized that the duration of life was longer in those cases not operated upon than in those where surgery was employed. Almost invariably the removal of the tumor was followed rapidly by recurrence and frequently in a few months the patient had multiple tumors where originally the tumor was followed rapidly by recurrence and frequently in a few months the patient had multiple tumors where originally the tumor was single. Surgeons were slow in recognizing that the papillary tumors of the bladder were of a peculiar nature in the ease with which they could be transplanted to other portions of the bladder, resembling in this respect an infection. To avoid this transplantation, protection of the wound area by gauze was adopted, the tumor was traumatized as little as possible during operation and strong solutions of resorcin and alcohol were employed in order to destroy any tumor cells which had been dislodged during operation. Despite all these efforts the results may be considered almost a complete failure in preventing prompt recurrence."

"A review of our results obtained in the removal of papilloma by operation up to 1910 has shown that in only one case was a cure effected. It is of interest to note in this connection that where extensive resection of the bladder wall was carried out for an infiltrating carcinoma, the results were far more encouraging. A probable explanation of this improvement in results lies in the fact that during operation detachment of tumor fragments of the infiltrating type is less liable to occur."

"Since 1911, at which time fulguration came into use, the operative methods in our clinic have been employed in only one case of papilloma. In this case several small tumors were situated on the anterior bladder wall just behind the vesical orifice in such a position that they could not be treated satisfactorily by endovesical methods. In this case the bladder was opened and the tumors destroyed by actual cautery, extreme care being employed to avoid implantation. This patient has been free from recurrence for two years."

"The treatment of bladder tumors by fulguration was productive of results that were immeasurably superior to those obtainel by any

operative procedures. It was soon found, however, that all vesical tumors disappeared rapidly, others responded only after long and vigorous applications, and others were not effected in the slightest degree. In order to understand the difference in the response to treatment, a study of the pathology of the different tumors was carried out, small fragments of tumors being excised before treatment was begun."

"The results of these studies showed that tumors which responded most readily to fulguration belonged to the benign papilloma type, while those which were not affected and were sometimes stimulated in their growth were papillary carcinomata. There is, however, an intermediate group of tumors, the malignant papilloma, which varies in its response to fulguration, some yielding almost as readily as the purely benign type, while others approach in their resistance the true papillary carcinoma."

"There is still considerable confusion in the literature regarding the terms benign papilloma, malignant papilloma and papillary carcinoma, and it may be well to define on what basis our classification of bladder tumors has been made. In the benign papilloma the connective tissue axis of each papilloma is covered by an epithelial structure which is identical with the bladder mucosa. In the malignant papilloma, however, changes in the arrangement of the epithelium, staining properties, size and shape of cells as well as certain nuclear changes are evident. The term, malignant papilloma, is applied to those tumors in which the malignant changes are confined to the epithelium alone, there being no evidence of invasion of the connective tissue framework. When the epithelium breaks through the basement membrane, invading the axis of the papilla, its main stalk or in the more advanced cases, the bladder wall itself, it no longer should be considered a malignant papilloma, but a papillary carcinoma."

"During the past four and a half years radium has been employed extensively in our clinic in the treatment of the various types of bladder tumor and its effect on the different types of tumor studied. During this period of time there have been observed in our clinic 170 cases of bladder tumor. Seventy-nine of these were classified as papilloma, either benign or malignant, or early papillary carcinoma in which there was no invasion of the bladder wall. There were 90 cases of infiltrating papillary carcinoma in which more or less extensive infiltration of the bladder wall was present and one case of basal-celled carcinoma."

"It has been our experience that all of the papillomata, either benign or malignant, together with the early papillary carcinomata, usually respond to vigorous radiation. The more malignant the tumor the greater the amount of radiation necessary to effect its disappearance. Where extensive infiltration of the bladder was present, the results with our present methods of radiation have so far been rather discouraging and in no case of extensive carcinoma have we succeeded in effecting a complete disappearance of the tumor. While the results in the treatment by radium of the extensively infiltrating tumors have been unsatisfactory, most brilliant results have been obtained in the less infiltrating types of early papillary carcinoma, ofttimes where the tumors were multiple and where successful resection could not be accomplished."

"While the majority of malignant papillomata respond to fulguration alone, there are certain cases which are most resistant to this method of treatment and in some which it is impossible to destroy by this means. Early in our experience with radium, it was found that if radiation were employed, the tumor was quickly transformed from one most resistant

to fulguration to one which responded as readily as the most benign type. It has been our experience that the early papillary carcinomata do not respond to fulguration and are frequently stimulated by the cauterization. This type of tumor which in the past required radical operative procedures with ultimate results usually bad will respond to radiation if the infiltration of the bladder wall is not too extensive. It is our routine at present to radiate all papillary tumors except those which are definitely of the benign type, in which fulguration rapidly effects a cure."

"The technic of application in the treatment of all these cases has been carried out with 103 to 210 mg. of radium element. In most cases the radium has been contained in a capsule of platinum or gold of sufficient thickness to filter out most of the irritating beta rays. Young has designed a cystoscope which carries the radium in the beak of the instrument. By this it is possible under direct vision to place accurately the radium on the tumor. After the radium has been brought in contact with the tumor, the cystoscope is held in a fixed position by means of a mechanical arm attached to the cystoscopic table. It is advisable to have the bladder moderately distended with water during the application, thus protecting the normal portions of the bladder from any possible irritating action of the radium. This is an important measure, as it enables one to give intensive treatment to the tumor without subjecting the normal bladder wall to the danger of a radium burn. In a few of our early cases in which this precaution was not taken ulcerations were observed. It is interesting to note that ulcerations were not particularly painful and usually healed in six months without any special treatment. The radiations are usually given for one hour, the applications being carried out from one to three times weekly, depending upon the size and character of the tumor and the reaction of the patient."

"*Diagnosis.*—The distinction between the benign and malignant papilloma is not of great clinical importance because the great majority of the latter group of tumors respond to fulguration. As fulguration fails utterly as a therapeutic measure in papillary carcinoma, an early differential diagnosis between this type of tumor and the papilloma is highly essential."

"*Cystoscopy.*—It is surprising how frequently from cystoscopy alone one can distinguish the papilloma from the papillary carcinoma. It is impossible from the cystoscopic appearance of the papilloma to determine whether it is benign or malignant. When, however, the malignant changes are so advanced that infiltration of the bladder wall has occurred, there are certain cystoscopic appearances which nearly always enable one to arrive at a fairly accurate diagnosis. The presence of necrosis in the papillæ is indicative of carcinoma, and is usually associated with invasion of the underlying bladder wall. In the earlier stages, when the tumor has just begun to invade the bladder wall, it may not be possible cystoscopically to determine this point; but when the process is at all advanced, the tumor loses its pedunculated character and becomes sessile in type. Frequently, around the margin of the tumor is seen edema, or bullae, which are usually indicative of a cancerous invasion of the bladder wall below. At other times little tumor nodules can be seen beyond the main tumor growth. This again is indicative of cancer. While it is impossible definitely to describe all the appearances which serve to differentiate the papillary carcinoma from the malignant papilloma, the cystoscopist of experience is usually able to make the dis-

tinction, and it is interesting to note how frequently the cystoscopic diagnosis proves to be correct."

"Palpation.—As the great majority of tumors occur on the posterior bladder wall in a position accessible to the examining finger, palpation furnishes valuable information, as induration can be detected when the tumor has infiltrated the bladder wall."

"Excision.—The excision of a piece of tumor for histological study was carried out systematically for several years, but now this is only occasionally resorted to, as the cystoscopic appearance, palpation and the symptoms usually furnish sufficient evidences for diagnosis. Furthermore, the evidence derived from microscopic examination is not always conclusive, because the portion removed may show none or very few malignant changes, while the remainder of the tumor may be definitely carcinomatous."

"Symptoms.—The presence of a severe intractible cystitis, when associated with bladder tumor, is in our experience strong evidence in favor of the growth's being an infiltrating one."

"CONCLUSIONS.—While benign and malignant papilloma and the early papillary carcinoma disappear under the influence of radium, the infiltrating types have proven very resistant to this agent. It is our procedure, therefore, when the infiltrating character of the growth has been determined and when the tumor is sufficiently localized to permit of complete removal, to carry out a radical resection. Following the removal of an infiltrating papillary carcinoma, cystoscopy should be done at an early date, as the not infrequent recurrences will yield promptly in many instances to radium, notwithstanding the resistance of the primary tumor. It is of interest to note that the use of radium has not diminished the tendency of bladder tumors to recur, recurrences being observed in about 30 per cent. of the cases treated. The recurrence, however, responds to radiation in most instances, although in three cases it did not yield. Radium has certainly proved to be a valuable aid in the treatment of bladder tumors, and while the results obtained in the infiltrating types are far from satisfactory, improved technic whereby more intensive radiation may be safely accomplished, may offer a more encouraging outlook in the future handling of these cases."

* * * * *

Edward A. Shumway, M.D. (Philadelphia). Vernal Conjunctivitis —Its Treatment by Applications of Radium. Penna. Med. Jour., 793-795, Sept., 1919. Read before the section on Pediatrics of the Medical Society of the State of Pennsylvania, Philadelphia Session, Sept. 26, 1919.

"Vernal conjunctivitis, or spring catarrh, is a chronic and very intractable affection of the conjunctiva, occurring chiefly in children and young adults, and, as its name implies, has its most decided manifestations in the spring and summer. It is a rather rare condition and is very frequently mistaken for trachoma, with which, however, it has little in common. It appears in two forms, one involving the conjunctiva of the eyeball and the other the conjunctiva of the upper lid. The first manifests itself in the form of brownish, uneven, hard nodules of gelatinious appearance at the limbus of the cornea, usually at the inner or outer side, which at times encroach on the cornea itself. This is the so-called limbus type. The other appears as broad, flat, fibrous masses, which have deep furrows between them, and project above the conjunctiva of the upper lid. In both types there is in addition a general in-

jection and thickening of the conjunctiva, and an appearance as though it was covered with a thin layer of milk. As a rule, the two types are distinct, although in some instances they occur together as a mixed form. The limbus lesions are very different from those occurring in phlyctenular disease, in that they never break down and ulcerate but remain often for years with but very little variation in size."

"The patients give a history usually of recurring attacks in the spring of the year, which commence as an ordinary catarrh, with some mucous discharge, and later intense itching and photophobia. The condition becomes worse during warm weather, making school attendance practically impossible, only to clear up again with the cool weather of the fall. The lid condition especially is frequently confounded with trachoma, but is to be distinguished in the first place by the history, and in the second place by the fact that the masses extend above the surface of the conjunctiva, instead of being partly buried in it; and also by the absence of infiltration and vascularity of the cornea. It is moreover not contagious, although there seems to be some proof that it may be hereditary, and it may occur in several members of the same family."

"Usually it is found in otherwise perfectly healthy children, and persists in recurring regularly every year, for from three up to ten or even twenty years. When it disappears, it usually leaves no trace behind, so that the ultimate prognosis for vision is good; whereas in trachoma, the cornea is commonly involved after twelve to eighteen months and, unless the disease is eradicated, vision is greatly affected."

"Treatment of vernal conjunctivitis has always been unsatisfactory. For years we have felt that simple cleansing lotions were most suitable. The addition of adrenalin to the boric acid solution (10 minims of the solution to the fluid-ounce) seems to relieve the itching for a time, and 1 per cent. solution of holocain is also very soothing. During the height of the attack, dark glasses must be worn, and they may be combined with the glass correcting any refractive error. Various other remedies have been recommended, such as solutions of quinin sulphate, antipyrin and protargol, but silver solutions should be avoided, as they will cause blackening or argyrosis of the conjunctiva, if employed for any length of time. Ointments of salicylic acid and yellow ovid of mercury have also been tried, but we have come to rely on the boric acid with adrenalin and holocain."

"For the cases which show the large, pavement-like masses on the eyelids, and the marked thickening about the limbus, treatment until recent years has been unavailing in removing the growths. Excision and rolling as in trachoma were not satisfactory, and the patients were treated symptomatically, until after years the growths disappeared. In recent years, however, as the result of the reported experiences of Abbe, Lawson, Schnaudigel, Shine, Harrison Butler and Allport, we have been employing radium, with gratifying results. In June, 1918, number of the *American Journal of Ophthalmology* I reported such a case in detail, and gave the literature to date. The patient was a boy of eleven years, who had been treated for five years at the eye dispensary of the University Hospital, without success, until in 1917 he was given a series of radium treatments by Dr. Henry K. Pancoast. In these treatments, from 35 to 50 mg. of radium were applied to the lids, the average time of exposure being fifteen minutes, and the result was the complete disappearance of the lid growths in four months time. During the past spring, there was a slight recurrence, but this was cured by one treat-

ment, so that the patient has been very comfortable during the present summer, and the lids are now smooth."

"During this year, Dr. Pancoast has treated for me four other patients. Of these two showed very pronounced development of the lid growths. One, the most extensive I have ever seen, was in a young man 22 years of age, who had been treated for trachoma for several months. He was given four treatments from April to August, and now shows very marked improvement, the greater part of the tarsal surface being free and showing very little roughening. In the other case, a girl of eight, after two treatments with 50 mg. for twenty minutes, at each application, the lid growths entirely disappeared, and the conjunctiva shows practically no scarring."

"In a third case with moderate limbus thickening, and a general thickening of the palpebral conjunctiva, in a girl of eight, the limbus nodules disappeared, and except during the very hot weather of the past August, the child's symptoms were distinctly ameliorated. In the fourth patient, a young man of seventeen, with limbus thickening and marked hypertrophy of the conjunctiva suggesting a case of trachoma complicated by vernal catarrh, which was referred to me by Dr. P. N. K. Schwenk, one treatment with 50 mg. of radium produced a very decided reaction, with a slight burn of the conjunctiva, and a subsequent punctate cloudiness of the cornea. Appropriate treatment cleared up the corneal opacities, but the patient refused treatment because of the reaction."

"The treatments are made as follows: Cocain is instilled, and the upper lid is everted by a pair of catch forceps, which are held in position against the forehead by a strip of adhesive plastre. The radium is enclosed in a tube of aluminum, 5 mm. in thickness, and applied directly to the exposed conjunctiva. At first the tube was fixed in one position, in a clamp, for the time of treatment, which averaged fifteen minutes, but the cases showed a superficial white slough of the conjunctiva, at the point of contact, and in the later treatments the nurse has been instructed to move the tube to different positions, and the burn has been avoided. Most of the patients show some skin reaction, in the form of an erythema of the lower lids, and a loss of the eyelashes. The latter, however, have grown in again in every instance after several months."

"We believe, therefore, that we can claim that the method is of great aid in curing these otherwise intractable cases. William Allen Pusey of Chicago has recently reported success with the use of small amounts of radium, applied daily in a varnish, in moderately pronounced cases, but we have found that in the bad types, the use of from 35 to 50 mg. for fifteen minutes, at intervals of two to four weeks, depending on the resulting reaction, have given us the most satisfactory improvement, and we believe the treatment should be better known, and more often employed."

* * * * *

Iser Solomon. Radio-Therapy in Germany (1914-1919. The Principles of Radio-Therapy. Jour. de Radiol. et d'Electrol. iv, 358-364, 1920.

"Deep radio-therapy is much more commonly used in Germany than in France where its use has not encountered so many obstacles as with us. As the radio-therapeutic technic depends upon the physical and biological principles of radio-therapy, radiologists, physicists, even derma-

tologists and eminent gynecologists have been forced, with more or less success, to study and define these fundamentals."

"Two problems particularly have been given attention by the German authors, these same problems having had our attention also, namely, the problem of securing homogeneous radiation, which is of more particular interest in deep radio-therapy, and the problem of the specific biological action of radiations of a given wave-length, this problem being equally interesting in superficial radio-therapy."

"The most remarkable book dealing with these questions is undoubtedly that coming from the collaboration of Professor Kronig, the gynecologist, with the well-known physicist, Friedrich. (Kronig and Friedrich. Physical and Biological Basis of Radio-Therapy, Berlin, 1918). In order to study these points a method of measurement is necessary which is both objective and sensitive."

"The authors have employed the ionometric method. Their arrangement consisted essentially in a measuring apparatus, a Wulf electrometer, and an ionization chamber. The Wulf electrometer is composed of two silvered quartz fibers, these two fibers separating more or less according to the value of the electrical charge which is communicated to the well-insulated system. The spreading of the two fibers is observed with a microscope. The quartz fibers are put in contact by means of a well-insulated wire with the central electrode of a small ionization chamber. A commutator puts the quartz fiber in contact with a storage-battery. Another commutator puts the quartz fibers in communication with a condenser whereby the capacity of the system may be increased, and its sensitiveness diminished by half."

"The ionization chamber used was constructed of cow horn and the interior wall was rendered conducting by the deposit of a layer of graphite. The other electrode was formed by a rod of graphite connected by a well-insulated wire to the measuring system. Friedrich and Kronig also used an ionization chamber of aluminum but this seemed less perfect to them than the graphite-horn chamber. The use of materials of low atomic weight is absolutely necessary in order to avoid all sources of characteristic radiation which would change in a considerable manner the iniozation measurements."

"The authors considered the rays filtered through 1 mm. of copper as approximately homogeneous, the rays filtered through ten mm. of aluminum being almost the same. (In reality the inspection of the graphs shows that with less filtration, beginning with 5 mm. of aluminum, the curve representing the logarithms of the intensity becomes a straight line; a sign of practical homogeneity). After filtration through 1 mm. of copper the spectral analysis shows still a rather large spectral range but in practice this fact is of no importance since the absorption curves indicate sufficiently the practical homogeneity of the radiations."

"In order that one may calculate the absorption in living tissues with absorption measurements made using the filters, it is necessary that there should be parallelism between the absorption of the filter and that of the tissue for the different radiations. Contrary to the opinion of Perthes, who stated that 1 cm. of tissue was equal to 1 mm. of aluminum, (this having been adopted by most radio-therapists) according to Friedrich and Kronig the ratio aluminum/tissue, or what comes to the same, the ratio of aluminum/water is not constant and varies from 0.91 for the soft rays to 0.48 for the very hard rays. Accordingly for the soft rays water or the tissues absorb almost like aluminum

while for the hard rays they absorb twice as much as aluminum. The use of aluminum "Phantoms" which has been quite common in Germany is therefore wholly defective."

"The authors give a new unit of measure to be used in radiology, a unit of quantity of radiation which they define as follows: It is the quantity of rays which produce in 1 cc. of air by ionization, under a saturation current, a quantity of electricity corresponding to one electrostatic unit. This new unit of measure is designated by the Gothic letter "e." The authors have compared their measuring apparatus, their iontoquantimeter, with the usual measuring apparatus (Kienbock strips, Sabouraud-Noire, and the Furstenau intensimeter). The Kienbock and Sabouraud-Noire methods are very insensitive. For example, with the radiometer of Sabouraud-Noire as modified by Holtzknecht they found

For 75 e ..... 1.5 - 1.75 H
For 115 e ..... 1.5 - 1.8 H
For 150 e ..... 2.0 - 2.5 H"

"It is necessary therefore to increase the quantity of radiation by 50 per cent. in order to detect a sensible difference in coloration. The same is found for the Kiebock strips. Furthermore, a number of the Kienbock strips, exposed the same time, under the same conditions, and developed correctly, gave differences amounting to more than 50 per cent."

"The authors employ as a "Phantom" a vessel filled with water and they introduce their ionization chamber to definite depths. Under these conditions the measurements are comparable to those which would be made in the interior of the body. On tracing the curve of intensities measured at different depths it is found that the curve shows a much smaller slope than that calculated by the laws of absorption and distance. For example, at 10 cm. depth the calculated dose is 8.4 per cent. while the measured dose was 31 per cent. This considerable difference depends on the secondary radiation coming from the tissues, the primary radiation only representing about 30-40 per cent. of the radiation registered by the iontoquantimeter. Another effect of the secondary rays: The deep dose for the same superficial dose depends on the size of the field of radiation and the ratio of the two doses is more favorable the larger the field is. In deep radio-therapy we therefore have a considerable advantage in using large focal distances and large portals of entry."

"Having thus determined the measurement and the manner of absorption of x-rays, the authors in a second part have studied the biological principles of radio-therapy. They have sought to solve the following problems:

"1. For the same absorption dose, is the biological action different according to the hardness of the rays?

"2. For the same dose, is the biological action the same according to whether one employs a large intensity for a short time or a small intensity for a longer time (Schwartzchild's law)?

"3. For the same dose, is the action the same according as one employs a massive dose or a fractional dose at determined intervals?

"4. For the same dose, is the biological action reinforced by factors as secondary radiation, diathermy, heat, etc.?"

"To determine these questions the authors have made experiments on the larvae of batrachians and on human tissue. A first series of experiments made on the larvae of batrachians showed that for difference of doses amounting to about 25 per cent. there could be observed dif-

ferences in the biological reaction which was shown by a higher mortality and the anomalies of development. The experimental "material" was therefore sufficiently sensitive. We will not here give the protocol of these experiments."

"The authors also made numerous experiments on three varieties of human tissue: Skin, ovary, carcinoma. Numerous plates in color show the observed modifications."

"These different experiments have permitted them to formulate the following answers to the above questions: 1. The intensity of the biological action for the same dose is the same for unfiltered rays, for rays filtered through 3 mm. of aluminum, for rays filtered through 1 mm. of copper, and for the gamma rays of radium and of mesothorium, filtered through 1.5 mm. of brass, covered with 5 mm. of celluloid. Within the limits of the hardness of the radiations employed, the intensity of the biological action appears independent of the hardness of the rays and depends solely on the quantity of radiant energy absorbed. The authors have experimented also with the biological action of the beta rays of uranium x and have found that these beta rays have a strong biological action analagous to that of the x-rays but a little more rapid (precoce.). In this case, likewise, for equal doses, there was equal biological action."

"2. If the ratio of intensity employed (the intensity of a massive dose and the intensity of a fractional dose) was equal to 1/5, such as ordinarily happens in practice, the intensity of a biological action for the same dose is independent of the intensity. For ratios greater than 1/5 the intensity of the biological action for the same dose is greater for the greater intensity."

"3. The intensity of the biological action is not the same when one applies the total dose at one seance as when one employs fractional doses."

"4. The experiments made on the larvae of Rana esculenta have shown that diathermy and heat in no way influence the biological action of the x-rays. The authors, likewise, tried the action of the secondary rays coming from the filters. When these rays are not absorbed by a screen the biological action is different and it is greater with lead and less with aluminum. If a supplementary filter is employed, such for example as a plaque of celluloid of 5 mm. thickness, this difference of action disappears. Researches made on the copper filter did not show the presence of any particularly dangerous radiation. Friedrich and Kronig have studied the biological action of secondary radiators (aluminum, iron, zinc, lead) and in spite of very prolonged exposures—12 hours per day for 3 days—they did not observe any visible action on the human skin."

"The authors fixed the erythema dose at 170 e. The ovarian dose necessary to obtain definite amenorrhoea is 33 e. The ratio of erythema dose/ovarian dose is 5. The carcinoma dose is the dose necessary to secure retrogression and disappearance of carcinoma. Its determination is difficult, there being considerable variation of the dose, depending on the case, at least for cancer of the breast, the authors estimate that it corresponds to 150 e. hence the ratio of erythema dose to carcinoma dose is 1.15. Even with the larvae the authors have noted considerable individual variation in the biological reactions, amounting to as much as 100 per cent. For carcinoma the individual differences are very considerable and cannot as yet be explained satisfactorily. For human skin there is occasionally observed considerable individual varia-

tion. For the ovaries, however, the individual differences are insignificant."

"A less extensive and less interesting work is the little book by Kupferle and Lilienfeld (Kupferle and Lilienfeld. The Basis of the Therapeutic Action of X-Rays Fribourg and Leipzig, 1917). This work is a long apology for the Lilienfeld tube. In order that the authors could study biological action of the x-rays of different wave-lengths, it was necessary that they have a source of homogeneous radiation or radiation rendered homogeneous. The Coolidge tube gave a very heterogeneous radiation and it was not possible to employ a secondary homogeneous radiation since it is too weak. The authors affirm that the Lilienfeld tube gives a radiation approximately homogeneous so that after filtration through 1.5 to 3 mm. of aluminum, 75 to 80 per cent. of the initial energy is obtained in the form of a homogeneous radiation of a desired hardness, up to 12 mm. half-absorption value for aluminum. (The Germans employ this notation introduced by Christen. The half-absorption thickness being the thickness of material necessary to absorb half the radiation, a radiation of 6° Benoist corresponds to a half absorption thickness 1.2). They have analyzed radiation by means of aluminum filters and the radiation is homogeneous from the point where the curve of the logarithm of intensity becomes a straight line. As a measuring apparatus the authors used a quadrant electrometer connected to an ionization chamber; the ionization thus measured would be directly proportional to the x-ray energy. They considered filtration through aluminum preferable."

"In a later article (Kupferle and Lilienfeld. Practical Dosimetry. Strahlentherapie, 1919, Vol. 9, Part 1) the authors call attention again to the importance of practically homogeneous radiation and describe an ionometer and and electroscope with a superposed ionization chamber which they call a maximeter. In an addendum, the authors throw doubt on certain propositions advanced by them in the following form: The greater hardness of the rays only serves to bear the energy to the more outlying layers, otherwise this quality of the rays has relatively little importance. They are of the opinion that often the energy of the rays exercises a sort of catalytic action. Kupferle and Axenfeld had observed in treating many cases of intraocular tumors that the retrogression of the tumor took place with lesions of the anterior segment of the eye using radio-therapy, and without lesions using the gamma rays of radium, although the total amount of energy put in play was considerably less in the second case."

"The work of Ernst and Dessauer (Some Problems in Deep Radio-Therapy. Ultra Hard X-Rays. Strahlentherapy, Vol. 5, Part 1, Page 161) is very much less interesting and we cite it only because of the notoriety of one of the authors. The authors have used the high tension generating apparatus of Dessauer, the Reform apparatus. The x-rays were received in a chamber lined with lead and in this chamber there was a secondary radiator. The primary radiation and the secondary radiation coming from the radiator were received in two ionization chambers connected to a quadrant electrometer. The authors showed first what is already perfectly well known: The complexity of the radiation coming from a gas tube, and arrive at the following astonishing conclusion: "It is possible technically to operate a tube at moderate hardness (6 to 7°B) in such a manner as to obtain approximately as much useful ultra-penetrating radiation as with an extremely hard tube." In the filtered beam they find rays of hardness approximating

those of radium. But from the figures given it does not seem that the x-rays obtained with the Reform apparatus attain even in any degree the hardness of the hard gamma rays of radium C. A reading of the article brings out the fact that the authors are not advised of the latest works on absorption and we have noted a number of errors."

"The question of the different biological action of x-rays of different qualities interests also the dermatologists and we will analyze several papers by dermatological radiologists. The most important paper by them is one by Rost (Privat-docent G. A. Rost, Experimental Researches on the Biological Action of X-Rays of Different Qualities on the Human and Animal Skin. Strahlentherapic, VI, p. 269). After some generalities on the nature and action of x-rays, Rost mentions the work of Regaud and Nogier in this field. In Germany, Bumm and Warnekros (Muench Med. Woch, No. 29, 1914) had claimed very remarkable results in the treatment of uterine cancer, by the use of formidable doses of strongly filtered x-rays; the skin having borne without damage the great quantities of the hard rays, dosimetric methods were useless; affirmation hardly likely."

"The experiments of Rost were made on the skin of pigs, which, according to the older results of Scholtz, behaves very much like the human skin. Other of Rost's experiments were made on human skin, almost always on normal tissue. In a first series he employed doses of 10 to 20x, using 1 to 4 mm. of aluminum filtration, as well as with no filters, while in a second series, 20 to 40x were used with the same conditions of filtration. All of the observations were given in detail in the article, and we namely reproduce here, almost verbtaim, the author's conclusions."

"There is no important difference between the action of hard (filtered) rays and soft (unfiltered) rays. The degree of the biological reaction of the rays depends in the main on the quantity of energy absorbed per unit of volume. The same biological reaction can be produced by the hard rays when they are absorbed in sufficient quantity. This research does not permit the assumption that there is a complete tolerance of the skin of the hard rays. Further, Rost denies the existence of a radio epidermititis (Regaud and Nogier), that is a localized inflammation of the epidermis. In addition to the germinative layer of the epidermis and of the hair root, the endothelial cells of the capillaries, the fixed connective cells and the epithelial cells of the sweat glands must be considered as very radio-sensitive. Probably the nucleus is the most sensitive part of the cell, the action of the rays being evidenced by its swelling, later atrophy and fragmentation (pycnosis). The cellular protoplasm is much less sensitive. The non-nucleated parts of the skin are—within large limits—faradio sensitive, (the horny layer, the elastic connective tissue and collagen, hairs). If the action of the rays is limited, the epithelium will be regenerated, because of the non-uniform action of the rays; the author has formed, within certain limits, patches of radiodermititis separated by intervals of healthy skin. Pigmentation of the skin is due to the formation of pigment both in the basal cells of the epidermis as well as in the chromatophores of the papillary layer. A passage of the pigment from the chromatophores into the inter epithelial spaces seems likely."

"Wetterer (Wetterer. Heavily filtered rays in dermatologic radiotherapy. Strahlentherapie, 1917, viii, p 100) also mentions the researches of Regaud and Nogier on the action of the heavily filtered x-rays, as well as the statement of Bumm and Warnekros regarding the

supposed harmlessness of the heavily screened rays, an opinion which Gauss and Lembke have strongly denied. Wetterer recalls that it was Dessauer who first in 1904 brought forward the idea that the selective action of the x-rays increased with their hardness and homogeneity. Wetterer, from a purely clinical viewpoint, cites a series of dermatological conditions in which the therapeutic results with the hard rays are far better. (Rays filtered through 4 mm. of aluminum). In hypertrychosis, sycosis and eczema of the face hard rays are better than the unfiltered, and with an appropriate technic atrophy of the skin and telangectasis may be avoided. In the not too inveterate cases of acne vulgaris filtered rays give an ideal result. In keloidal acne the results with very hard rays are splendid. There is likewise a rapid healing in juvenile warts. Wetterer places a coating of bismuth paste between warts, to protect the healthy skin. In lupus vulgaris the filtered rays act better than the unfiltered. In cutaneous tuberculosis he counsels the exclusive use of very hard rays. It is only in chronic eczema and in psoriasis that the unfiltered rays seem to yield better results."

"For Brauer (Brauer. Are the hard rays biologically more effective than the soft? Strahlentherapie, 1918, viii, p 548.) the hard rays are not biologically more effective than the soft, but therapeutically the hard rays are more effective, since for physical reasons they act in a more selective manner. The physical reason for this difference of action coming about through the inequalities in absorption, the elements to be treated lying at variable depths in the various cutaneous layers. With hard rays the absorption being the same or nearly so, only the differences in radiosensibility of the various tissues comes into play."

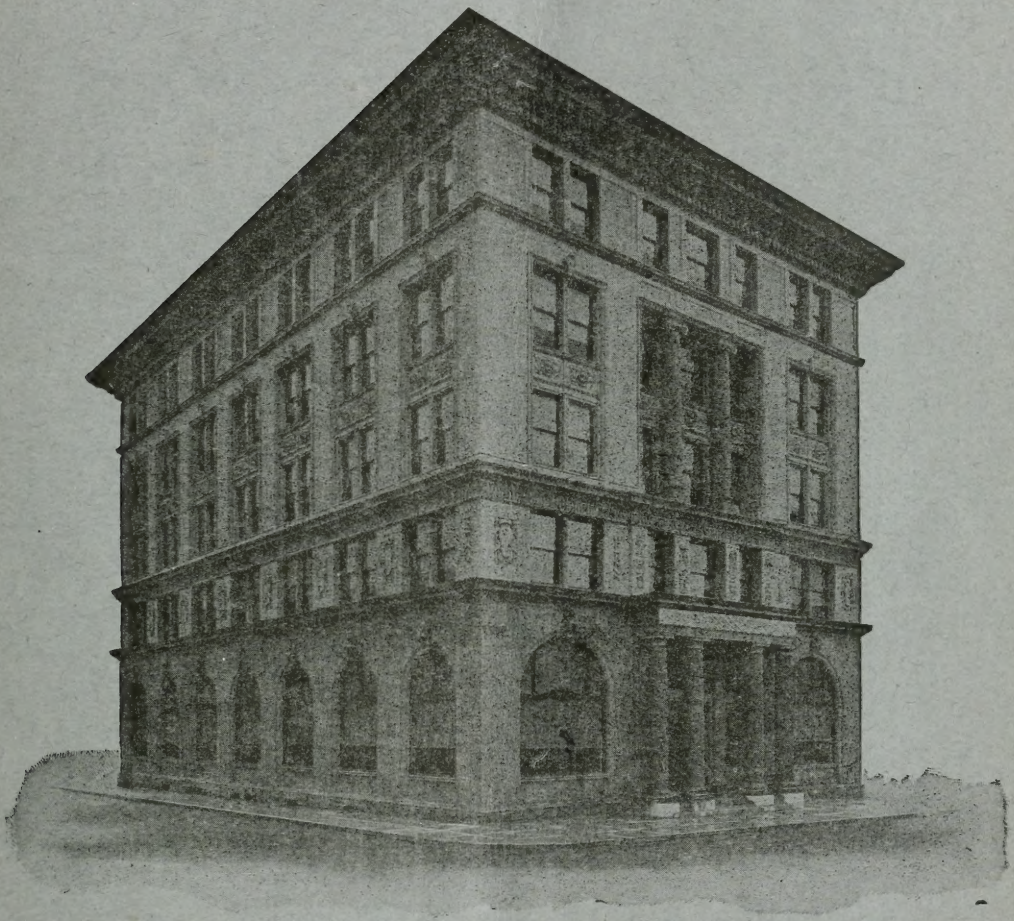
"Gunsett (Gunsett. Radiotherapy of superficial conditions with heavy doses of strongly filtered rays, particularly in cancroids and hypertrychosis. Strahlentherapie, 1914, v, p 219.) found that many skin conditions are better influenced by the very hard rays. More particularly he treated many cancroids with strongly filtered rays (4 mm. of Al.) and using heavy dosage (15 to 20 H measured with the Bordier radiochromometer and the Nogier lamp) and obtained excellent results. Following Regaud and Nogier's technic in hypertrychosis the author obtained good results, and is led to believe that this method will replace electrolysis."

"In another article Gunsett discusses the same questions (Gunsett. Radiotherapy in Dermatology. Strahlentherapie. 1916, vii, 6 639). The first part of this article, which is a general review, is devoted to dosimetry. According to Gunsett radiation may be considered practically homogeneous after filtration through 4 mm. of aluminum. In Germany considerable use is made of the notation "half absorption thickness" (halbwertschicht, abr. H. W. S.) and Gunsett gives a table which shows the correspondence with the degrees Benoist, a table useful in reading German articles."

Degrees Benoist	H. W. S.
5	1.0 cm. Al.
6	1.2 "
7	1.4 "
8	1.6 "
8 plus 0.5 mm Al.	1.8 "
8 " 1. " "	2.0 "
8 " 2. " "	2.25 "
8 " 3. " "	2.25 - 2.5 cm.
8 " 4. " "	2.5 cm."

STANDARD CHEMICAL COMPANY

PITTSBURGH, PA.



General Offices and Radium Research Laboratory, Standard Chemical Company, Pittsburgh, Pa.

Miners of Uranium and Vanadium Ores, and Producers of Radium

STANDARD CHEMICAL COMPANY

RADIUM

STANDARD CHEMICAL CO.

RADIUM APPLICATORS

Standard and Special Designs

Sold with Bureau of Standard's Certificate

Departments of Physics and Medicine for instruction in the physics of Radium and the technic of the therapeutic application of Radium and Radium Emanation.

RADIUM CHEMICAL COMPANY

GENERAL OFFICES AND LABORATORIES

Pittsburgh, Pa.

New York	Boston	San Francisco	Chicago
501 Fifth Avenue	Little Building	Flood Building	Marshall Field Annex Bldg.

London

Watson & Sons (Electro-Medical) Ltd., 43 Parker Street, Kingsway, W. C. 2